Correlation between the charged kaon ratio and the baryon phase-space density in heavy-ion collisions [1]

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It has been observed that the ratio of the charged kaon total yields (K^+/K^-) in Si+Al, Si+Au, and Au+Au collisions at the AGS varies little with the collision centrality [2]. In the constituent quark model, $K^+ = u\overline{s}$ and $K^- = \overline{u}s$. Hence, K^+/K^- depends on the baryon (baryon − antibaryon) density established in the collision zone. The constant K^+/K^- ratio implies a constant baryon density over the collision centrality, which is a rather counter-intuitive result.

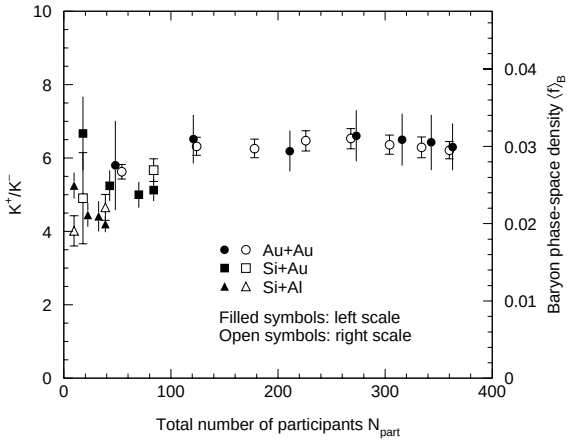

Figure 1: The K^+/K^- ratio (filled symbols) and $\langle f \rangle_B$ (open symbols) as a function of the number of participants at the AGS.

We report here a study of the correlation between K^+/K^- and the average baryon phase-space density in heavy-ion collisions. We extract the average baryon phase-space density from deuteron coalescence measurement by E859/E866 [3]. The results are in shown Fig. 1 as a function of the number of participants. Also shown are the K^+/K^- ratios [2]. The astonishing feature of the figure is that both quantities in Au+Au collisions are correlated almost perfectly, including the small deviations from a constant in both quantities. This feature offers an explanation for the puzzling centrality independence of the K^+/K^- ratio [2].

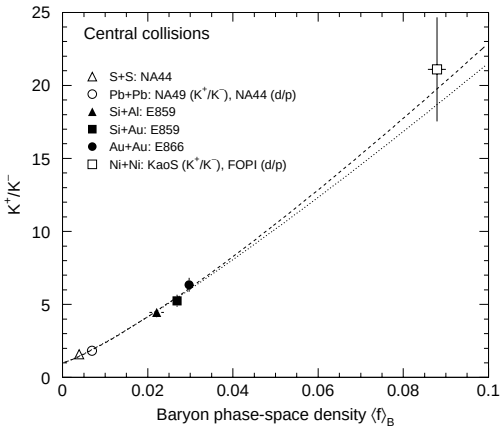

Figure 2: The K^+/K^- ratio as a function of $\langle f \rangle_B$ in central heavy-ion collisions. The curves are different power-law fits.

We further extract the average baryon phase-space density and the K^+/K^- ratio from central heavy ion collisions at different energies. Figure 2 shows K^+/K^- as a function of the average baryon phase-space density. Both quantities decrease with beam energy. The data from various collision systems at different beam energies follow a common systematic. This systematic may provide predictions for the upcoming RHIC data as well as the low energy data at the AGS and SPS.

References

[1] F. Wang, nucl-ex/9911004 [LBNL-45032].

[2] E802 Collaboration, L. Ahle *et al.*, Phys. Rev. **C60**, 044904 (1999).

[3] E802 Collaboration, T. Abbott *et al.*, Phys. Rev. **C50**, 1024 (1994); E802 Collaboration, L. Ahle *et al.*, Phys. Rev. **C60**, 064901 (1999).